

### **REMARKS**

This Preliminary Amendment cancels, without prejudice, claims 1 to 14 in the underlying PCT Application No. PCT/EP2004/010957 and adds new claims 15 to 27. The new claims, inter alia, conform the claims to United States Patent and Trademark Office rules and does not add any new matter to the application.

In accordance with 37 C.F.R. § 1.125(b), the Substitute Specification (including the Abstract) contains no new matter. The amendments reflected in the Substitute Specification (including Abstract) are to conform the Specification and Abstract to United States Patent and Trademark Office rules or to correct informalities. As required by 37 C.F.R. §§ 1.121(b)(3)(ii) and 1.125(c), a Marked-Up Version of the Substitute Specification comparing the Specification of record and the Substitute Specification also accompanies this Preliminary Amendment. Approval and entry of the Substitute Specification (including Abstract) are respectfully requested.

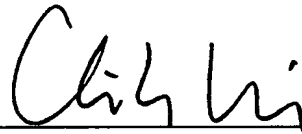
The underlying PCT Application No. PCT/EP2004/010957 includes an International Search Report, dated January 28, 2005, a copy of which is included. The Search Report includes a list of documents that were considered by the Examiner in the underlying PCT application.

It is respectfully submitted that the subject matter of the present application is new, non-obvious and useful. Prompt consideration and allowance of the application are respectfully requested.

Respectfully submitted,

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## BALL SOCKET

**FIELD OF THE INVENTION**

The **present** invention relates to a ball socket for receiving a ball and to a rotatably mounted connecting arrangement for connecting two components in a vehicle.

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**BACKGROUND INFORMATION**

Rotatably mounted connecting arrangements for connecting vehicle components or ball joints can perform various functions in motor vehicles. One component that is to be connected has a ball at one end, while the other component that is to be connected has a ball socket or ball cage at one end. To provide the connection between the two components, the ball is received in the ball socket or ball cage. This arrangement allows the two components to pivot relative to one another about a common pivot point which is arranged in the ball joint.

~~Known~~ **Conventional** single-piece ball sockets made from soft material do not have the rigidity required for certain applications. Single-piece ball sockets made from hard and brittle plastic do have the required rigidity but are subject to the drawback that they can break when they are bent open during fitting to the ball. Consequently, the strip thickness and the wrapping of the ball socket around the ball are subject to restrictions. ~~The fact that forced~~ **Forced** deformation ~~is to be~~ **being** possible during insertion of the ball into the ball socket is detrimental to the shape of the ball sockets.

30 German ~~laid open specification DE~~ **Published Patent Application No.** 42 11 897 [[A1]] describes a ball joint for parts of a steering mechanism or wheel suspension of motor vehicles.

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MARKED-UP VERSION OF THE  
SUBSTITUTE SPECIFICATION

EV 320 246 142 US

This ball joint has a radially resilient bearing socket which is made from plastic and accommodates a ball head of a link pin. The outer circumference of the bearing socket is mounted in a recess in a joint housing, and a cylindrical part of its peripheral surfaces bears against a cylindrical wall portion. The bearing socket surrounds the ball head by means of a securing member which is inserted into the housing recess and secures the bearing socket prestressed therein. The bearing socket has a slot passing through it transversely to the circumferential direction. Insertion of the ball into the bearing socket is facilitated by this design.

#### SUMMARY

~~It is an object~~ Example embodiments of the present invention ~~to improve the~~ provide for configuration of a ball socket and for configuration of a rotatably mounted connecting arrangement.

~~For this purpose, the invention proposes a ball socket having the features of patent claim 1 and a rotatably mounted connecting arrangement having the features of patent claim 11.~~

The ball socket ~~according to the invention~~ for receiving a ball ~~has~~ includes at least one region which ~~consists of~~ includes an elastically deformable material or has an elastically deformable geometry. The result of this is that the ball socket ~~does~~ may not break when it is bent open as a result of the ball being introduced and then returns to its original position. This allows may provide for simple assembly of a ball joint ~~comprising~~ that includes a ball socket and a ball. Moreover, the ball ~~[[is]]~~ may be securely received in the ball socket ~~according to the invention.~~

The ball socket ~~is preferably designed in~~ may be arranged such ~~a way that it covers a ball portion, which is delimited by at~~

least one circle, of the ball. It is also possible for the ball socket to be ~~designed in~~ arranged such a way that it covers a ball portion, which is delimited by two circles arranged parallel to one another and is ~~designed~~ arranged as a ball layer, of the ball. It ~~is in each case~~ may be provided that the ball socket engages around an equator of the ball. The ball portion may be ~~designed in~~ arranged such a way that it surrounds the ball apart from an opening at one pole of the ball. The ball layer is ~~in this case~~ formed ~~[[in]]~~ such a way that it surrounds the ball apart from two openings at opposite poles of the ball. The ball socket, which is ~~designed~~ arranged as a ball layer, covers the ball in a region up to several degrees above the equator and also in a region up to several degrees below the equator of the ball.

It may be provided that the ball socket has at least one gap. ~~In this case~~ For example, the at least one gap ~~[[is]]~~ may be oriented perpendicular to the at least one circle, ~~in particular~~ e.g., to the at least two circles, of the ball socket ~~designed~~ arranged as a ball layer. An opening of this type arranged at the ball socket ~~allows~~ may allow widening of the ball socket during fitting of the ball.

~~In a further advantageous configuration of the invention, the~~ The elastically deformable region is ~~designed~~ may be arranged as an elongate portion which is arranged diagonally with respect to the gap. This ~~makes~~ may make it easy for the ball socket to widen during assembly. ~~On account of the fact that~~ Since the gap and the elastically deformable region are arranged diagonally with respect to one another, maximum opening of the ball socket ~~[[is]]~~ may be possible in a direction perpendicular to the gap.

Alternatively, the ball socket may have two gaps which are arranged diagonally with respect to one another along a

circumference of the ball. On account of this configuration of the ball socket, there are two options for an advantageous arrangement of the elastically deformable region.

5 The elastically deformable region may be arranged between a gap. If the ball socket is ~~designed~~ arranged in the form of a ball layer with two gaps arranged diagonally with respect to one another, this configuration ~~of the invention~~ in functional terms corresponds to the variant of forming the ball layer  
10 with a gap and an elastically deformable region arranged diagonally with respect to the gap as the elongate portion. However, if the ball socket is formed as a ball portion which is delimited by one circle, this ball portion may have a gap at which the elastically deformable region is arranged.  
15 Therefore, a single-piece ball socket having two components which ~~can~~ may move relative to one another by ~~way of~~ the elastically deformable region is in each case provided.

If the ball socket has two gaps, it ~~is also recommended~~ may be  
20 provided that the elastically deformable region ~~[[be]]~~ is arranged between a first point and a second point of the circle which delimits the ball socket. This ~~advantageously also provides~~ may provide a cohesive, single-piece ball socket which has two components which are connected such that they  
25 ~~can~~ may move relative to one another by ~~means of~~ the elastically deformable region and form a ball socket.

The two components of the ball socket which are connected to one another by ~~way of~~ the elastically deformable region may  
30 ~~consist~~ be formed of hard and brittle plastic. The elastically deformable region ~~can~~ may be of thin-walled design. This means that the elastically deformable region has a lower wall thickness than the two components. On account of this configuration, the ball socket ~~can~~ may easily be deformed  
35 along the elastically deformable region ~~[[in]]~~ such a ~~way~~ that

the other two components forming the ball socket ~~can~~ may move in a simple way manner relative to one another and, moreover, securely hold the ball within the ball socket.

5 In the rotatably mounted connecting arrangement ~~according to the invention~~ for connecting two parts in a vehicle, the first part has a ball as connecting element and the second part has the ball socket ~~according to the invention~~ as a connecting element for receiving the ball. A connecting arrangement of  
10 this type or a ball joint of this type ~~[[is]]~~ may be versatile in use in the motor vehicle. Assembly ~~can~~ may be executed without problems on account of the ~~advantageous~~ configuration of the connecting arrangement.

15 Further ~~advantages~~ aspects and configurations of example embodiments of the present invention ~~will emerge from the description and~~ are described below with reference to the appended drawing Figures.

20 It ~~will~~ should be understood that the features referred to above and those which are yet to be explained below ~~can~~ may be used not only in the combination indicated in each instance but also in other combinations or also as stand-alone measures, without departing from the spirit and scope ~~of the~~  
25 ~~present invention~~ hereof.

~~The invention is diagrammatically depicted in the drawing on the basis of an exemplary embodiment and is described extensively below with reference to the drawing, in which:~~

30

#### BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 ~~shows~~ schematically illustrates a first configuration of the a ball socket according to an example embodiment of the present invention.

35

Fig. 2 ~~shows~~ is a sectional cross-sectional view of the ball socket according to the invention in a first configuration illustrated in Fig. 1.

5 Figs 3 to 5 ~~show~~ schematically illustrate the insertion of a ball into ~~[[a]]~~ the ball socket in accordance with the first configuration of the invention illustrated in Figs. 1 and 2.

Fig. 6 ~~shows~~ schematically illustrate a ball socket in a  
10 second configuration according to an example embodiment of the present invention.

Fig. 7 ~~shows~~ is a sectional cross-sectional view through the ball socket in the second configuration of the invention  
15 illustrated in Fig. 6.

Figs. 8 and 9 ~~show~~ schematically illustrate the insertion of a ball into a ball socket in accordance with the second configuration illustrated in Figs. 6 and 7.

#### DETAILED DESCRIPTION

The figures Figures are described jointly and in an interrelated way manner. Identical reference designations denote identical components.

25 The first An example embodiment of the a ball socket 1 according to the invention, which is illustrated from various perspectives and in different states in Figs. 1 to 5, has the following components: two part-sockets 2a, 2b, which are  
30 connected to one another via an elastically deformable region 6 ~~[[in]]~~ such a way that the entire ball socket 1 is of single-piece, cohesive design arrangement. Moreover, the ball socket 1 has a first gap 4a and a second gap 4b. The first gap 4a separates the two part-sockets 2a, 2b from one another.  
35 Along the second gap 4b is arranged the elastically deformable

region 6, by which the two part-sockets 2a, 2b are connected to one another so that they jointly and in single-piece form produce the ~~first embodiment of the ball socket 1 according to the invention.~~

5

Fig. 2 ~~shows~~ illustrates the ball socket 1 ~~from~~ illustrated in Fig. 1 in a ~~sectional~~ cross-sectional view from a perspective corresponding to the two arrows indicated in Fig. 1. This perspective reveals the part-socket 2b. The section passes  
10 through the two gaps 4a (left-hand side) and 4b (right-hand side) arranged diagonally with respect to one another. The elastically deformable region 6 is arranged along the gap 4b illustrated on the right-hand side, diagonally with respect to the gap 4a illustrated on the left-hand side. Fig. 2 also  
15 indicates an equator line illustrating an equator 8 of the ball 10. The part-socket 2b, relative to the equator 8, extends from a first angle region above the equator 8 to a lower angle region below the equator 8. The same applies to the part-socket 2a. This ~~ensures~~ provides that a ball which  
20 is to be received by the ball socket 1 is substantially covered or encircled so that the ball is securely held in the ball socket.

Fig. 3 ~~shows~~ illustrates a ball 10 of this type before it is  
25 introduced into the ball socket 1 during assembly. The ball socket 1, and ~~in particular,~~ e.g., the elastically deformable region 6, are in a load-free state in ~~this figure~~ Fig. 3.

As ~~shown~~ illustrated in Fig. 4, the ball 10 has been forced by  
30 pressure sufficient to overcome a mechanical resistance of the elastically deformable region 6 to penetrate partway into the receiving regions, delimited by the part-sockets 2a (right-hand side) and 2b (left-hand side), of the ball socket 1. This stretches the elastically deformable region 6 arranged  
35 along the gap 4b. This ~~can~~ may be recognized ~~from the fact~~ in



that the distance between the two part-sockets 2a, 2b as  
illustrated in Fig. 4 is greater than the distance illustrated  
in Fig. 3. ~~On account of~~ Due to the elastically deformable  
region which connects the two part-sockets 2a, 2b to one  
5 another, these two part-sockets 2a, 2b ~~can~~ may be moved  
relative to one another when the ball 10 is being inserted  
into the ball socket 1.

~~For this purpose,~~ Fig. 5 ~~shows~~ illustrates how the ball 10 has  
10 been completely received in the ball socket 1. The ball  
socket 10 is covered within the region covered by the two  
part-sockets 2a, 2b. Since the elastically deformable region,  
after insertion of the ball 10 into the ball socket is  
complete, springs back into its original shape, the ball 10 is  
15 securely received in the ball socket 1.

The ball socket 1 covers or receives the ball 10 in the region  
of what is referred to as a ball layer. This ball layer is  
delimited at the top by a circle 9a indicated by a circle line  
20 and at the bottom by a circle 9b indicated by a circle line.  
These two circles 9a, 9b are arranged parallel to the equator  
8 indicated by the equator line.

Figs. 6 to 9 ~~show~~ illustrate a ball socket 11 in a further  
25 configuration ~~of the invention~~. This ball socket 11 is formed  
by two part-sockets 12a, 12b, which are connected to one  
another by ~~means of~~ an elastically deformable region 16. The  
two part-sockets 12a, 12b are separated by two gaps 14, which  
are arranged or oriented perpendicular to the elastically  
30 deformable region 16. The elastically deformable region is  
arranged between two portions 30, 31 of a circle 29 which is  
interrupted by the gaps 14 and delimits the two part-sockets  
12a, 12b.

Fig. 7 ~~shows~~ illustrates the ball socket 11 in accordance with the sectional view indicated by the two arrows ~~from~~ illustrated in Fig. 6. This illustration clearly reveals the single-piece design arrangement of the ball socket 11, i.e.,  
5 the unit made up of the left-hand part-socket 12a, the elastically deformable region 16 and the right-hand part-socket 12b. ~~The figure~~ Fig. 7 also ~~shows~~ illustrates the gap 14. As in the exemplary embodiment of the ~~first~~ ball socket 1 illustrated in Figs. 1 to 5, the part-sockets 12a, 12b and  
10 therefore the entire ball socket 11 extend from a region above an equator 18 indicated by an equator line to a region below the equator 18 indicated by the equator line. Consequently, the ball 11 received by the ball socket 11 ~~can~~ may be securely held in place.

15 Fig. 8 ~~shows~~ illustrates, in a corresponding way manner to Fig. 4, how a ball 20 is inserted into the ball socket 11. On account of a force with which the ball 20 is pressed ~~downward~~ downwardly, the two part-sockets 12a, 12b are folded open in  
20 scissor or clamp fashion, with the elastically deformable region 16 stretching. A relative movement of the part-socket 12a with respect to the part-socket 12b of this type when the ball 20 is being received is made possible by the nature of the elastically deformable region 16. As a result, the gap 14  
25 is widened from the bottom upward.

Fig. 9 ~~shows~~ illustrates the ball 20 which has been received in a ball socket 11. After the ball 20 has been inserted, the elastically deformable region 16 snaps or springs back into a  
30 starting position. This restores the original distance between the two part-shells 12a, 12b. The gap 14 also reverts to its original width and the ball 20 is covered over a ball layer by the ball socket 11. This ball layer is delimited at the top by a circle 19a indicated by a circle line and at the

bottom by a circle 19b indicated by a circle line, both of which are arranged parallel to the equator 18.

5 The ball sockets 1, 11 ~~according to the invention can~~ may have a greater wall thickness than ~~known~~ conventional ball sockets and permit the ball 10, 20 to be engaged around to a greater extent. This ~~results~~ may result in a wider range of applications with hard and brittle plastics. Furthermore, the wear resistance under very high loads ~~[[is]]~~ may be increased.

10 Axial and radial prestressing conditions are may be significantly improved compared to the ~~cited prior art~~ conventional devices ~~([[DE]] such as those described, e.g., in German Published Patent Application No. 42 11 897 [[A1]])~~, so that, for example, there ~~[[is]]~~ may be no need to provide any

15 protection against twisting. The ~~invention allows~~ devices hereof may provide an in relative terms thicker, more wear-resistant ball socket 1, 11 to be provided under the same installation conditions.

20 The design and assembly problems which ~~generally~~ may occur with ~~known~~ conventional devices are may be eliminated in accordance with the ~~first embodiment of the~~ ball socket 1 by the elastically deformable region 6 arranged along the gap 4b. Contrary to other design solutions, only tensile forces may

25 occur along the elastically deformable region, which may be designed, for example, as a thin-walled gap 4b. A ~~further advantage is that a~~ ball geometry which is provided by the region covered by the ball socket 1 ~~[[is]]~~ may not be affected by forced deformation.

30 ~~In the second embodiment of the invention, embodied by the~~ With respect to ball socket 11, design and assembly problems which occur ~~are~~ may be eliminated by the elastically deformable region 16 which is arranged in a lower region of

35 the ball socket 11. The elastically deformable region 16 of

the ball socket 11 may ~~in this case~~, for example, be designed  
arranged in the form of a web and surround a pole of the ball  
20 below the equator 18. ~~In this case too, it is~~ It may be  
provided that the thin-walled, elastically deformable region  
5 16 of web-like ~~design~~ arrangement is easily deformable  
compared to the remainder of the ball socket, ~~in particular~~  
e.g., the two part-sockets 12a, 12b.

~~Abstract~~

**ABSTRACT**

The A ball socket ~~(1)~~ ~~according to the invention~~ for receiving a ball has at least one region ~~(6)~~ which ~~consists of~~ includes  
5 an elastically deformable material or has an elastically deformable geometry. ~~The result of this is that the~~ The ball socket ~~(1)~~ ~~does~~ may not break when it is bent open for introduction of the ball ~~(10)~~ and then springs back into its original position. This ~~on the one hand allows~~ may provide  
10 simple assembly of a ball joint ~~comprising~~ including a ball socket ~~(1)~~ and a ball ~~(10)~~. Moreover, the ball ~~(10)~~ ~~is~~ may be securely received in the ball socket ~~(1)~~ ~~according to the invention~~.

15 ~~(Fig. 4)~~